

REMARKS/ARGUMENTS

Favorable reconsideration of this application in view of the above amendment and following remarks is respectfully requested.

Claims 1, 2, 4-17, 20, and 21 are pending. Claims 13, 16, and 17 are withdrawn. In the present amendment, Claims 1, 10, and 14 are amended; Claims 3, 18, and 19 are canceled without prejudice or disclaimer; and new Claims 20 and 21 are added. Support for the present amendment can be found in the original specification, for example, at page 21, lines 9-25. Thus, it is respectfully submitted that no new matter is added.

In the outstanding Office Action, Claim 3 was rejected under 35 U.S.C. §112, second paragraph; Claims 1-4, 6, 10, 11, 18, and 19 were rejected under 35 U.S.C. § 102(e) as anticipated by Yoshitaka (U.S. Patent No. 6,764,939); Claims 1-3, 6-8, and 18 were rejected under 35 U.S.C. § 103(a) as unpatentable over Tsai et al. (U.S. Publication No. 2004/0161946, hereinafter “Tsai”) in view of Jiwari et al. (U.S. Publication No. 2003/0025209, hereinafter “Jiwari”); Claims 4, 5, and 9 were rejected under 35 U.S.C. § 103(a) as unpatentable over Tsai and Jiwari in view of Hongo et al (U.S. Publication No. 2002/0046808, hereinafter “Hongo”); Claim 12 was rejected under 35 U.S.C. § 103(a) as unpatentable over Yoshitaka in view of Kumar et al. (U.S. Publication No. 2003/0084587, hereinafter “Kumar”); and Claims 14 and 15 were rejected under 35 U.S.C. § 103(a) as unpatentable over Ito et al. (U.S. Publication No. 2003/0116854, hereinafter “Ito”) in view of Sugahara et al. (U.S. Patent No. 5,989,998, hereinafter “Sugahara”).

With respect to the rejection under 35 U.S.C. §112, second paragraph, Claim 3 is canceled without prejudice or disclaimer. Accordingly, the rejection is moot.

Turning now to the rejections under 35 U.S.C. § 102(e) and 35 U.S.C. § 103(a), Applicants respectfully request reconsideration of these rejections and traverse these rejections, as discussed below.

Amended Claim 1 recites, in part, “modifying a chemical composition of said F-doped carbon film with nitrogen radicals consisting of Ar and nitrogen.” As discussed in the original specification at page 9, lines 19-26, by modifying the claimed F-doped carbon film with nitrogen radicals consisting of Ar and nitrogen, a highly reliable electrical contact for a barrier metal is formed. It is respectfully submitted that the cited references do not disclose or suggest every feature recited in Claim 1.

Specifically, Yoshitaka describes a semiconductor device manufacturing method in which a fluorine containing carbon film 206 is formed by a plasma deposition process using C_4F_6 and C_2H_4 gas. An insulating film 208 of SiCN is then formed on the film 206. On the film 208, a resist pattern 211 is formed that is then used as a mask to etch the films 208 and 206. A plasma of a mixed gas of H_2+N_2+Ar is used to etch the fluorine-containing carbon film 208 (asserted in the Office Action as corresponding to the claimed modifying said F-doped carbon film by nitrogen radicals). However, the mixed gas of Yoshitaka includes H_2 gas. Further, it is respectfully submitted that the etching described in Yoshitaka does not modify a chemical composition of the fluorine containing film 206. Thus, Yoshitaka does not disclose or suggest “***modifying a chemical composition*** of said F-doped carbon film with nitrogen radicals ***consisting of Ar and nitrogen***,” as recited in amended Claim 1.

Accordingly, it is respectfully requested that the rejection of Claim 1, and all claims dependent thereon, as anticipated by Yoshitaka, be withdrawn.

The Office Action further rejects Claim 1 based on Tsai and Jiwari. The Office Action asserts that the claimed modifying said F-doped carbon film by nitrogen radicals corresponds to forming the fluorocarbon film by using a mixed gas of $(C_xF_y + N_2)$ described in Tsai. Jiwari describes depositing a second fluorine-containing organic film and densifying the second fluorine-containing organic film by “exposing the second fluorine-containing

organic film to plasma of a rare gas in the reactor chamber.”¹ The Office Action further asserts that when forming the second fluorocarbon film on the first fluorocarbon film in Jiwari, the first fluorocarbon film can be modified by a nitrogen radical by using the mixed gas of ($C_xF_y + N_2$) as a material gas (based on a combination of Tsai and Jiwari). However, Tsai and Jiwari do not disclose or suggest “*modifying a chemical composition* of said F-doped carbon film with nitrogen radicals *consisting of Ar and nitrogen*,” as recited in amended Claim 1. Accordingly, it is respectfully requested that the rejection of Claim 1, and all claims dependent thereon, as unpatentable over Tsai in view of Jiwari, be withdrawn.

Independent Claim 10 recites, in part, “modifying a chemical composition of at least said sidewall surface of said opening with nitrogen radicals consisting of Ar and nitrogen.” Accordingly, in light of the above discussion with respect to the rejections of Claim 1, it is respectfully submitted that Yoshitaka, Tsai and Jiwari do not disclose or suggest each of the features recited in amended Claim 10. Accordingly, it is respectfully requested that Claim 10, all claims dependent thereon, be allowed.

Independent Claim 14 is amended to recite “depositing a second metal film that forms a stable compound of a metal fluoride when reacted with F, such that said second metal film covers at least said sidewall surface and bottom surface of said opening.” It is respectfully submitted that the second metal film described in each embodiment of Ito is an oxide metal film (for example, the Al film cited on page 11 of the Office Action). Thus, Ito does not disclose or suggest the claimed structure having the CF interlayer insulating layer and the *fluoride metal film*, as recited in amended Claim 14. Instead, as discussed in paragraph [0074], in the third embodiment of Ito a metal oxide layer is formed, and it is essential that an oxide material, which contains oxygen, is used for the formation of the low-K dielectric film. Further, it is respectfully submitted that Sugahara does not cure the deficiencies of Ito.

¹ See Jiwari, at paragraph [0020].

Accordingly, it is respectfully requested that the rejection of Claim 14, and Claim 15 which depends thereon, as unpatentable over Ito in view of Sugahara, be withdrawn.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. A Notice of Allowance is earnestly solicited.

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